Title of project: Partnering for Pesticide Reduction: Using grower partnerships to develop resources for increasing use of biocontrol in NYS greenhouses.

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Abstract: New York State has approximately 23.8 million square feet of greenhouse space for the production of floricultural crops with over 800 producers. Insect pests are usually controlled through a combination of cultural and chemical methods and the majority of growers use some integrated pest management (IPM) practices in their insect management system. Because of the number of pests that thrive in the greenhouse environment and consumer demand for high quality plants, the total number of insecticide applications made to a crop can be high. Biological control of insect pests as an alternative to chemical insect management fits well into many greenhouse IPM programs. However, adoption by growers is limited by the complexity of incorporating it into an existing production system, confusion on how it can be integrated with chemical control, and the relatively small number of existing users and educators who can provide information and assistance to growers. Because of this, growers from New York and throughout the northeastern US have identified the need for resources on how to use biocontrol as one of their educational priorities.

We propose partnering with growers and the greenhouse industry group NYS Flower Industries (NYSFI) to create a workbook on getting started using biocontrol for greenhouse insect management. Such a resource needs to be practical, easy to use and adaptable to a wide variety of crops, pests, and environments. Growers with experience in using biocontrol will act as an advisory group to evaluate a draft document. Project investigators and five NYS growers who are interested in developing a biocontrol program will use the workbook to plan and implement biocontrol of bedding plants in the spring of 2011 as on-farm demonstrations. After incorporating comments from both grower groups, we will promote the workbook through on-farm Open Houses in Fall 2011 with the involvement of the trial and advisory growers and NYSFI. Cornell Cooperative Extension will also be involved in promotion through their annual Bedding Plant Schools. An on-line interactive version will be available through the NYS Integrated Pest Management program website in 2012.

Increasing the use of biocontrol will impact environmental and human health through reductions in insecticide applications while still maintaining product quality. Based on surveys of the trial growers and those attending Open Houses, we will document the reduction in number and level of insecticide applications, and potential for applicator exposure. Expected outcomes include a 50% reduction in insecticide applications on biocontrol treated crops by trial growers with 80% of them expanding their use of biocontrol in the future. The availability of a workbook and its promotion by growers who have used it successfully will result in 30% of those attending Open Houses adding biocontrol to their insect management system. There will be a 10% increase in the area of NYS greenhouses using biocontrol by 2012. Crop quality will be maintained or improved in the on-farm greenhouse trials.

Justification:

Background

New York State has approximately 23.8 million square feet of greenhouse space for the production of floricultural crops with over 800 producers (USDA Floriculture Crops Summary 2008). Insect pests are usually controlled through a combination of cultural and chemical methods and the majority of growers use some integrated pest management (IPM) practices in their insect management system. Because of the number of pests that thrive in the greenhouse environment and consumer demand for high quality plants, the total number

of insecticide applications to a single greenhouse crop can be high. Biological control of insect pests as an alternative to chemical insect management fits well into many IPM programs. However, adoption by growers is limited by the complexity of incorporating it into an existing production system, confusion on how it can be integrated with chemical control, and the relatively small number of existing users and educators who can provide assistance and education to growers.

The NYS IPM Ornamentals program has been providing educational programming on biocontrol for NYS greenhouse growers for the last three years. Funding from the New York Farm Viability program allowed us to hold on-farm workshops to 1) introduce the use of biocontrol, and 2) give growers hands-on experience with beneficial insects. As part of the evaluation of this biocontrol programming, growers have asked for resources to assist them in using biocontrol. Also, growers and specialists from the Northeast identified "Guidelines on what, when, how many, and how to apply biological control organisms . . .." as a priority educational need (2009 Pest Management Strategic Plan for Commercial Greenhouses in the Northern United States).

We propose writing a workbook on "Getting Started with Biocontrol for Greenhouse Insect, Management" that will be evaluated by growers experienced with biocontrol, and trialed with growers that are just starting to use it. This resource would begin to fill in the information gap and increase the use of biological control of insect pests in NYS greenhouses. Growers using biocontrol are able to reduce the number of insecticide applications, reserving then for essential uses such as before shipping or reducing high pest populations in isolated 'hot spots'.

Target pests, crops, and pesticides
Growing bedding plants is the most common greenhouse production system in the Northeast and will be used as the framework to evaluate the workbook, although the workbook will be applicable to a broader range of greenhouse production systems. A typical retail or wholesale greenhouse will produce 50-100 species and cultivars of flowering and edible crops as bedding plants. Target pests will vary with crops and location but will likely include thrips, fungus gnats, whitefly, and aphids. Insecticides targeted for reduced use will be determined by the crop/pest system of interest for each trial greenhouse.

Pesticide reduction
Increasing the use of biological control to manage insects results in the reduction of insecticide use through extending the period in which pest numbers are below thresholds, potentially for the whole season. Our experience suggests that the successful use of biological control for one target pest in a greenhouse leads to growers expanding their use of biological control to other pests and other crops. Therefore, a resource that can assist growers in successfully getting started using biocontrol will result in a continuing reduction in insecticide use at that operation, as they increase their use of biocontrol over time.. Also, we have found that successful growers often encourage additional growers to attempt the use of biocontrol.

Agronomic and economic impact
Pesticide resistance is increasing in some of the most commonly used pesticides for control of greenhouse insects. Without new tools for control, growers may use additional applications of less effective insecticides and face reductions in yield and quality due to insects and the diseases they spread. Incorporating biological control into the pest management system can reduce losses and maintain the high levels of quality that consumers demand. A strict comparison of costs of biological vs. chemical control does not always show that biological control is less expensive. However, other factors may affect the economic benefit line, such as saving money by being able to control insects while workers or customers are in the greenhouse. In some cases, growers have marketed their products as sustainably produced, based on their use of biological control.

Environmental/human health
Most greenhouse growers use pesticides appropriately to reduce the likelihood of pesticide residues reaching the groundwater or being released as volatiles. However, the potential exists for damage to the environment, especially in regions such as Long Island NY that have sandy soils and high water tables. Reducing the number of times pesticides must be applied by keeping insects below economic thresholds with biocontrol therefore also limits the potential for release of pesticides to the environment. Pesticide exposure is most likely for greenhouse workers who apply the pesticides. In addition, customers may come in contact with pesticide residues. Many greenhouses are in the urban/rural interface because they require both space and easy access to consumers. Biological control agents have no negative effects on environmental or human health. Many of the organisms are native to NYS or cannot survive outside of the greenhouse.

Sustainability of project after project period
The print and on-line versions of the workbook will be available to growers interested in using biocontrol after the project period is over. NYS IPM is committed to promoting biocontrol as a part of integrated pest management for ornamental production and the workbook will be a valuable resource. We will continue to seek projects that increase the use of biocontrol and reduce pesticide impacts on environmental and human health. As we continue to work with growers, improvements and additions may be made to the workbook to improve its usefulness and accessibility. We will also continue to measure increases in use of biocontrol and reductions in pesticide application after the project period.

Objectives: In conjunction with grower partners, create, evaluate, promote and distribute a print and on-line workbook on "Getting Started with Biocontrol for Greenhouse Insect Management" in order to reduce pesticide applications in New York State (NYS) greenhouses

Procedures:
1. Develop and review draft workbook
During evaluations of previous NYS IPM educational programming on biocontrol for greenhouses, growers have told us that they would like a resource to help them determine which beneficials to use and specifics on how to use them. As some growers have begun to use biocontrol, we have also identified the pests and beneficials most important to cover and some characteristics that are conducive to success. This information will serve as the basis for a draft workbook to assist growers in getting started with biocontrol for insect management in greenhouses. The workbook format was chosen to be interactive, practical, and easy to use. The intent is that by answering a few questions on pests, the grower will be directed to pages on the appropriate beneficial organisms (biology, environmental preferences, etc.) and how to apply them (rate, frequency, method, etc.).

The draft will be reviewed by an advisory group of greenhouse growers who have experience using biocontrol in their own greenhouses. Dan Gilrein and Dr. John Sanderson, Cornell University entomologists who work with biological control in greenhouse production, will also review the workbook. This expertise will be invaluable in making the workbook practical and relevant to beginning growers. Karen Dean Hall, representing NYSFI, will be actively involved in the development and review of the workbook.

2. Evaluate draft workbook through on-farm trials
In order to evaluate the workbook, we will use it as a resource in working with five greenhouse growers across NYS who are interested in using biocontrol but have little or no experience with it. The evaluation will be based on 3 greenhouse visits, and other communication as needed. The initial meeting will be held before the Spring 2011 season begins to discuss which pests the growers would like to control, and their needs and expectations for biocontrol. During the second visit, we will help growers with their first application of biocontrols. The third will be at the end of the season to collect information on

the success of the biocontrol, to assist growers with planning for future use of biocontrol, and to collect information that will be used to improve the workbook as a guide for growers.

As we work with the growers, we will collect information on their current chemical treatments for the pests to be controlled with biocontrol, and the reduction in number and quantity of pesticides used because of the use of biocontrol. At the end of the season, we will also collect information on the costs of biocontrol, crop quality and losses, as part of the evaluation of the workbook.

3. Finalize print version and create on-line interactive version
Changes will be made to the draft workbook based on comments from reviewers and from the growers in the on-farm trial. Print copies will be made available to growers through NYS IPM as well as through the programs described below. Copies will also be distributed to CCE educators who work with greenhouse growers and advertised through educators in other states in the northeast.

As soon as the formatting for the print version is complete, the web and computer staff of NYS IPM will create the on-line interactive version. The workbook will be posted on the NYS IPM website and publicly available at no charge.

4. Promote and distribute workbook through on-farm Open Houses and Bedding Plant Schools
On-farm Open Houses will be held in Fall 2011, with the assistance of NYSFI, at each of the greenhouses where trials were done, or at a greenhouse in the area if the trial growers have no fall crops. The grower and the investigators will discuss the use of the workbook, and the program will include some hands-on activities. Print copies will be made available to growers that attend. Our previous experience with similar Open Houses suggests that an average of 40 growers will attend each program.

For the Open Houses, the project personnel will initiate the workshop. It will be advertised through the NYSFI newsletter, the NYS IPM Ornamentals IPM e-newsletter, CCE newsletters, and a direct mailing. The announcement will have the NYS IPM and NYSFI logos on it, and a statement that indicates funds for the workshop were provided by the US EPA. The primary audience will be NYS greenhouse growers, although the events are public and everyone is welcome to attend. No program income will be generated from the Open Houses. Program evaluation results will be compiled by the project personnel and made available to interested parties.

Bedding Plant Schools are put on by CCE educators and NYS Flower Industries each January in Albany, New Paltz, Long Island, and Buffalo. We will introduce the workbook to growers at those schools and give them a chance to ask questions on how it can be used. Average attendance at each Bedding Plant Schools is about 80.

We will also promote the workbook through the Ornamental IPM e-newsletter to CCE educators throughout the state. Copies will be sent to greenhouse specialists in other states in the Northeast so they can promote the workbook to their growers.

5. Survey trial growers and growers at Open Houses
In order to evaluate the potential for continued reductions in pesticide use throughout the industry, the trial growers will be surveyed for their intent to continue and expand their use of biocontrol to cover additional pests. Growers who attend the Open Houses will also be asked to describe their previous use of biocontrol if any, and their intent to start using it after learning about the workbook.

Results to date:
PROGRESS REPORT (September 1, 2011):

1) **Comparison of actual accomplishments with anticipated outputs/outcomes specified in workplan:**
   By the end of the first year, we had hoped to have a completed and reviewed biocontrol workbook. We have not met that goal, although several sections of the workbook are nearly complete and we have been working with growers throughout the program to evaluate what we have accomplished.

   Through another project we have several grower meetings scheduled where we can get grower input on the workbook to help recapture some of our lost time. Also, on-farm programs will be scheduled during the late winter spring education season for greenhouse growers to highlight the workbook.

2) **Reasons why anticipated outputs/outcomes were not met:**
   The late start has had lingering effects on accomplishing goals. However, we are in a period of more concentrated work on meeting targets and I am sure we will finish the project approximately on time.

Implications:
Preliminary discussions with growers suggest that the workbook will be well received.